We claim:

1. A process for separating a heavy key component from an inlet gas stream containing a mixture of methane, C_2 compounds, C_3 compounds, and heavier compounds, comprising the following steps:

(a) at least partially condensing and separating the inlet gas to produce a first liquid stream and a first vapor stream;

(b) expanding at least a portion of the first liquid stream to produce a first fractionation feed stream;

(c) supplying a fractionation column the first fractionation feed stream and a second fractionation feed stream, the fractionation column produces a fractionation overhead vapor stream and a fractionation bottom stream;

(d) expanding at least a portion of the first vapor stream to produce an expanded vapor stream;

(e) supplying an absorber the expanded vapor stream and an absorber feed stream, the absorber produces an absorber overhead stream and an absorber bottom stream, the absorber having an absorber pressure that is substantially greater than and at a differential pressure from the fractionation column;

(f) compressing at least a portion of the fractionation overhead vapor stream or a second vapor stream essentially to the absorber pressure to produce a compressed second vapor stream;

(g) at least partially condensing the compressed second vapor stream to produce the absorber feed stream; and

whereby the fractionation bottom stream contains a majority of the heavy key component and heavier compounds.

2. The process for separating the heavy key component of claim 1 wherein the absorber pressure is at least about 500 psia.

3. The process for separating the heavy key component of claim 1 wherein the differential pressure in step (e) is about 50 psi to 350 psi.

4. The process for separating the heavy key component of claim 1 wherein the at least partially condensing of step (a) occurs in an apparatus selected from the group consisting of a heat exchanger, a liquid expander, vapor expander, an expansion valve and combinations thereof.

5. The process for separating the heavy key component of claim 1 wherein the first fractionation feed stream and the second fractionation feed stream of step (c) are supplied to a middle portion of the fractionation column.

6. The process for separating the heavy key component of claim 1 wherein the compressed second vapor stream of step (f) contains a major portion of the methane in the fractionation feed stream and second fractionation feed stream.

7. The process for separating the heavy key component of claim 6 wherein the heavy key component is C_3 compounds and heavier compounds and the compressed second vapor stream contains a major portion of the C_2 compounds in the fractionation feed stream and the second fractionation feed stream.

8. The process for separating the heavy key component of claim 1 wherein the absorber of step (e) has at least one vertically spaced tray, one or more packed beds, any other type of mass transfer device, or a combination thereof.

9. The process for separating the heavy key component of claim 1 wherein the fractionation column of step (c) has at least one vertically spaced tray, one or more packed beds, any other type of mass transfer device, or a combination thereof.

10. The process for separating the heavy key component of claim 1, wherein the heavy key component is C_3 compounds and heavier compounds and further comprises the following steps:

(a) at least partially condensing the fractionation overhead vapor stream to produce a condensed fractionation overhead stream;

(b) separating the condensed fractionation overhead stream to produce a second vapor stream and a fractionation reflux stream;

(c) supplying the fractionation column with the fractionation reflux stream;

(d) cooling the fractionation bottom stream and supplying a portion of the fractionation bottom stream to the fractionation column as a fractionation reflux stream;

(e) condensing at least a portion of the first liquid stream before producing the first fractionation column stream from step (b); and

whereby the fractionation bottom stream contains the majority of the heavy key component and heavier compounds.

11. The process for separating the heavy key component of claim 10 further comprising the following steps:

(a) heating at least a remaining portion of the first liquid stream producing a third fractionation feed stream; and

(b) supplying the third fractionation feed stream to the fractionation tower or to the first fractionation feed stream.

12. The process for separating C_3 compounds and heavier compounds of claim 10 further comprising the following steps:

(a) expanding the absorber bottom stream;

(b) at least partially condensing the absorber bottom stream to form a condensed absorber bottom stream;

(c) separating the condensed absorber bottom stream into a separated vapor stream and a separated liquid stream where the first separated liquid stream is 0% to 100% of the separated liquid stream;

(d) separating the separated liquid stream into a first separated liquid stream and a second separated liquid stream;

(e) supplying the second separated liquid stream to the fractionation column;

(f) combining the first separated liquid stream with the separated vapor stream to form the second fractionation feed stream;

(g) heating the second fractionation feed stream; and

(h) supplying the second fractionation feed stream to the fractionation column.

13. The process for separating the heavy key component of claim 10 wherein the heavy key component is C_3 compounds and heavier compounds and the condensing of step (g) from claim 1 occurs by heat exchange contact with one or more process streams selected from the group consisting of the absorber bottom stream, the absorber overhead stream, at least a portion of the first liquid stream and combinations thereof.

14. The process of separating the heavy key component of claim 10 wherein the heavy key component is C_3 compounds and heavier compounds and the first fractionation feed stream and the second fractionation feed stream supplied to the fractionation column are cooled by an heat

exchange contact with process streams selected from the group consisting of the absorber overhead stream, inlet gas stream, the compressed second vapor stream, fractionation overhead vapor stream, and combinations thereof.

15. The process of separating the heavy key component of claim 14 wherein the heavy key component is C_3 compounds and heavier compounds and the heat exchange contact occurs in an apparatus selected from the group consisting of a heat exchanger and a condenser.

16. The process of separating the heavy key component of claim 10 wherein the heavy key component is C_3 compounds and heavier compounds and the first fractionation feed stream supplied to the fractionation column in step (c) of claim 1 is cooled by heat exchange contact with the absorber overhead stream in a heat exchanger;

wherein the fractionation overhead vapor stream in step (c) is at least partially condensed in an external refrigeration system; and

wherein step (g) includes condensing the compressed second vapor stream by heat exchange contact with the absorber overhead stream.

17. The process of separating the heavy key component of claim 1 wherein the heavy key component is C_3 compounds and heavier compounds and the absorber overhead stream in step (e) is sent to an internal condenser of the fractionation column.

18. The process of separating the heavy key component claim 17 wherein the heavy key component is C_3 compounds and heavier compounds are at least partially condensed in the internal condenser that uses an external refrigeration system, producing the fractionation overhead vapor stream.

19. A process for separating the heavy key component of claim 1, wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the following steps:

(a) removing a first liquid condensate stream from a removal tray that is below a lowest feed tray;

(b) warming the first liquid condensate stream;

(c) returning the first liquid condensate stream back to a return tray that is between removal tray and the lowest feed tray;

(d) removing a second liquid condensate stream from a second removal tray that is between the lowest feed tray and the removal tray;

(e) warming the second liquid condensate stream;

(f) returning the second liquid condensate stream back to a second return tray that is between the second removal tray and the removal tray;

(g) supplying to the absorber a second absorber feed stream; and

whereby the fractionation bottom stream contains the majority of the heavy key component and heavier compounds.

20. The process for separating the heavy key component of claim 19 wherein the heavy key component is C_2 compounds and heavier compounds and the condensing of step (g) from claim 1 is by heat exchange contact with a process stream selected from the group consisting of the portion of the first vapor stream portion, the absorber overhead stream and combinations thereof.

21. The process of separating the heavy key component of claim 19 wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the step of supplying to the absorber a second absorber feed stream selected from the group consisting of a condensed portion of the second expanded vapor stream and at least a portion of a residue gas second expanded vapor stream.

22. The process of separating the heavy key component of claim 21 wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the following steps:

(a) supplying a cold absorber a split feed stream and a second split feed stream;

(b) feeding the colder of the split feed stream and the second split feed stream to the top of the cold absorber; and

(c) feeding the warmer of the split feed stream and the second split feed stream to the bottom of the cold absorber.

23. The process of separating the heavy key component of claim 19 wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the step of cooling, at least partially condensing, and expanding the second absorber feed stream prior to supplying the second absorber feed stream to the absorber.

24. The process of separating the heavy key component of claim 23 wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the step of adding at least a portion of first liquid stream as a liquid slip stream to the second absorber feed stream prior to cooling and at least partially condensing the second absorber feed stream.

25. An apparatus for separating a heavy key component from an inlet gas stream containing a mixture of methane, C_2 compounds, C_3 compounds and heavier compounds, comprising:

(a) a cooling means for at least partially condensing and separating the inlet gas stream to produce a first vapor stream and a first liquid stream;

(b) an expansion means for expanding the first liquid stream to produce a first fractionation feed stream;

(c) a fractionation column for receiving the first fractionation feed stream and a second fractionation feed stream, the fractionation column produces a fractionation overhead vapor stream and a fractionation bottom stream;

(d) a second expansion means for expanding at least a portion of the first vapor stream to produce an expanded vapor stream;

(e) an absorber for receiving the expanded vapor stream and an absorber feed stream, the absorber produces an absorber overhead stream and an absorber bottom stream, the absorber having an absorber pressure that is substantially greater than and at a differential pressure from the fractionation column;

(f) a compressor for compressing at least a portion of the fractionation overhead vapor stream or a second vapor stream essentially to the absorber pressure to produce a compressed second vapor stream;

(g) a condensing means for at least partially condensing the compressed second vapor stream to produce the absorber feed stream; and

whereby the fractionation bottom stream contains the majority of the heavy key component and heavier compounds.

26. The apparatus for separating the heavy key component of claim 25 wherein the absorber pressure of step (e) is at least about 500 psia.

27. The apparatus for separating the heavy key component of claim 25 wherein the differential pressure from step (e) is about 50 psi to 350 psi.

28. The apparatus for separating the heavy key component of claim 25 wherein the cooling means of part (a) is selected from the group consisting of a heat exchanger, a liquid expander, a vapor expander, an expansion valve and combinations thereof.

29. The apparatus for separating the heavy key component of claim 25 wherein the first fractionation feed stream and the second fractionation feed stream are supplied to about a middle portion of the fractionation column.

30. The apparatus for separating the heavy key component of claim 25 wherein the heavy key component is C_3 compounds and heavier compounds and further comprising the following:

(a) a condensing means for at least partially condensing the fractionation overhead vapor stream to produce a condensed fractionation overhead stream;

(b) a separating means for separating the condensed fractionation overhead stream to produce a second vapor stream and a fractionation reflux stream;

(c) the fractionation column for receiving the fractionation reflux stream;

(d) a bottoms exchanger for receiving and cooling the fractionation bottom stream and supplying a portion of the fractionation bottom stream to the fractionation column as a fractionation reflux stream; and

whereby the fractionation bottom stream contains the majority of the heavy key component and heavier compounds.

31. The apparatus for separating the heavy key component of claim 30 wherein the heavy key component is C_3 compounds and heavier compounds and further comprising the following steps:

(a) a heating means for heating at least a remaining portion of the first liquid stream producing a third fractionation feed stream; and

(b) the fractionation column or the first fractionation feed stream for receiving the third fractionation feed stream.

32. The apparatus for separating the heavy key component of claim 31 wherein the heavy key component is C_3 compounds and heavier compounds and further comprising the following steps:

(a) a third expansion means for expanding the absorber bottom stream;

(b) a cooling means for at least partially condensing the absorber bottom stream to form a condensed absorber bottom stream;

(c) a separating means for separating the condensed absorber bottom stream into a separated vapor stream and a separated liquid stream;

(d) a second separating means for separating the separated liquid stream into a first separated liquid stream and a second separated liquid stream where the first separated liquid stream is 0% to 100% of the separated liquid stream;

(e) the fractionation column for receiving the second separated liquid stream;

(f) a combining means for combining the first separated liquid stream with the separated vapor stream to form the second fractionation feed stream;

(g) a heating means for heating the second fractionation feed stream; and

(h) the fractionation column for receiving the second fractionation feed stream.

33. The apparatus for separating the heavy key component of claim 30 wherein the heavy key component is C_3 compounds and heavier compounds and the heat exchanger at least partially condenses the compressed second vapor stream by heat exchange contact with one or more process streams selected from the group consisting of the fractionation feed stream, the absorber overhead stream and combinations thereof.

34. The apparatus for separating the heavy key component of claim 25, wherein the heavy key component is C_2 compounds and heavier compounds and further comprising the following steps:

(a) the fractionation column for removing a first liquid condensate stream from a removal tray that is below a lowest feed tray;

(b) a heating means for warming the first liquid condensate stream;

(c) the fractionation column for returning the first liquid condensate stream back to a return tray that is between removal tray and the lowest feed tray;

(d) the fractionation column for removing a second liquid condensate stream from a second removal tray that is between the lowest feed tray and the removal tray;

(e) a second heating means for warming the second liquid condensate stream;

(f) the fractionation column for returning the second liquid condensate stream back to a second return tray that is between the second removal tray and the removal tray;

(g) the absorber for receiving a second absorber feed stream; and

whereby the fractionation bottom stream contains the majority of the heavy key component and heavier compounds.

35. The apparatus for separating the heavy key component of claim 34 wherein the heavy key component is C_2 compounds and heavier compounds and the fractionation column includes one or more side reboilers that are in heat exchange contact with process streams selected from the group consisting at least a portion of the inlet gas stream, at least a portion of a residue gas stream and combination thereof.

36. The apparatus for separating the heavy key component of claim 34 wherein the heavy key component is C_2 compounds and heavier compounds and the cooling means of step (a) from claim 24 further comprise a cold absorber with one or more mass transfer stages for receiving at least a portion of a condensed inlet gas stream, the cold absorber producing the first liquid stream and the first vapor stream.

37. The apparatus for separating the heavy key component of claim 25 wherein the absorber of step (e) has at least one vertically spaced tray, one or more packed beds, any other type of mass transfer device, or a combination thereof.

38. The apparatus for separating the heavy key component of claim 25 wherein the fractionation column of step (c) has at least one vertically spaced tray, one or more packed beds, any other type of mass transfer device, or a combination thereof.

39. The apparatus for separating the heavy key component of claim 25 further comprising a vessel for separating a condensed absorber overhead stream into a separated vapor stream and a separated liquid stream.

40. The apparatus for separating the key component of claim 25 wherein the compressed second vapor stream contains a major portion of the methane in the fractionation feed stream and the second fractionation feed stream.

41. The apparatus for separating the heavy key component of claim 40 wherein the heavy key component is C_3 compounds and the compressed second vapor stream contains a major portion of the C_2 compounds in the fractionation feed stream and the second fractionation feed stream.

42. The apparatus for separating the heavy key component of claim 25 wherein a pressure difference between the absorber and the fractionation column flows the fractionation feed stream to the fractionation column.

43. The apparatus for separating the heavy key component of claim 25 wherein the heavy key component is C_3 compounds and heavier compounds and the condensing means is selected from the group consisting of a heat exchanger and an internal condenser of the fractionation column.

44. The apparatus for separating the heavy key component of claim 43 wherein the heavy key component is C_3 compounds and heavier compounds and the fractionation overhead stream is at least partially condensed in an external refrigeration system.

45. The apparatus for separating the heavy key component of claim 25 wherein the heavy key component is C_3 compounds and heavier compounds and further comprising a compressor for compressing the absorber overhead stream to at least above about 500 psia.